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YAZMIN MURRAY

Nonlinear Control Systems Design 1989 Springer Science & Business Media
During the past decade we have had to confront a series of control design prob lems - involving, primarily, multibody electro-mechanical systems - in which nonlinearity plays an essential role. Fortunately, the geometric theory of non linear control system analysis progressed substantially during the 1980s and 90s, providing crucial conceptual tools that addressed many of our needs. However, as any control systems engineer can attest, issues of modeling, computation, and implementation quickly become the dominant concerns in practice. The prob lems of interest to us present unique challenges because of the need to build and manipulate complex mathematical models for both the plant and controller. As a result, along with colleagues and students, we set out to develop computer algebra tools to facilitate model building, nonlinear control system design, and code generation, the latter for both numerical simulation and real time con an outgrowth of that continuing effort. As trol implementation. This book is a result, the unique features of the book includes an integrated treatment of nonlinear control and analytical mechanics and a set of symbolic computing software tools for modeling and control system design. By simultaneously considering both mechanics and control we achieve a fuller appreciation of the underlying geometric ideas and constructions that are common to both. Control theory has had a fruitful association with analytical mechanics from its birth in the late 19th century.
Analysis and Design of Nonlinear Control Systems SIAM
Stability of Nonlinear Control Systems
Stability of Nonlinear Control Systems Springer Science & Business Media
From the reviews: "The book is an excellent combination of theory and real-world applications. Each application not only demonstrates the power of the theoretical results but also is important on its own behalf." IEEE Control Systems Magazine
Nonlinear Control Systems Springer Science & Business Media
This book is a tribute to Prof. Alberto Isidori on the occasion of his 65th birthday. Prof. Isidori’s proli?c, pioneering and high-impact research activity has spanned over 35 years. Throughout his career, Prof. Isidori has developed ground-breaking results, has initiated researchdirections and has contributed towardsthe foundationofnonlinear controltheory.In addition,his dedication to explain intricate issues and di?cult concepts in a simple and rigorous way and to motivate young researchers has been instrumental to the intellectual growth of the nonlinear control community worldwide. The volume collects 27 contributions written by a total of 52 researchers. The principal author of each contribution has been selected among the - searchers who have worked with Prof. Isidori, have in?uenced his research activity, or have had the privilege and honour of being his PhD students. The contributions address a signi?cant number of control topics, including th- retical issues, advanced applications, emerging control directions and tutorial works. The diversity of the areas covered, the number of contributors and their international standing provide evidence of the impact of Prof. Isidori in

the control and systems theory communities. The book has been divided into six parts: System Analysis, Optimization Methods, Feedback Design, Regulation, Geometric Methods and Asymptotic Analysis, re?ecting important control areas which have been strongly in- enced and, in some cases, pioneered by Prof. Isidori.

Nonlinear Control Systems and Power System Dynamics Springer

The purpose of this book is to present a self-contained description of the fun damentals of the theory of nonlinear control systems, with special emphasis on the differential geometric approach. The book is intended as a graduate text as weil as a reference to scientists and engineers involved in the analysis and design of feedback systems. The first version of this book was written in 1983, while I was teach ing at the Department of Systems Science and Mathematics at Washington University in St. Louis. This new edition integrates my subsequent teaching experience gained at the University of Illinois in Urbana-Champaign in 1987, at the Carl-Cranz Gesellschaft in Oberpfaffenhofen in 1987, at the University of California in Berkeley in 1988. In addition to a major rearrangement of the last two Chapters of the first version, this new edition incorporates two additional Chapters at a more elementary level and an exposition of some relevant research findings which have occurred since 1985.

Nonlinear Control Systems Springer Science & Business Media

Nonlinear Output Regulation: Theory and Applications provides a comprehensive and in-depth treatment of the nonlinear output regulation problem. It contains up-to-date research results and algorithms and tools for approaching and solving the output regulation problem and related problems, such as robust stabilization of nonlinear systems. Output regulation is a general mathematical formulation of many control problems encountered in daily life including cruise control of automobiles, landing and takeoff of aircraft, manipulation of robot arms, orbiting of satellites, and speed regulation of motors. The book provides a self-contained treatment starting with an introduction to the linear output regulation problem and a review of the fundamental nonlinear control theory. The author's presentation strikes a balance between the theoretical foundation of the problem and the practical applications of the theory. The book is accompanied by many examples, including practical case studies with numerical simulations based on MATLAB/SIMULINK. Audience: graduate students, professors, and researchers in applied mathematics, electrical engineering, mechanical engineering, and aerospace engineering. The book can be used in a graduate-level control systems course as well as by control design engineers in industry.

Nonlinear Systems Birkhäuser

This eagerly awaited follow-up to Nonlinear Control Systems incorporates recent advances in the design of feedback laws, for the purpose of globally stabilizing nonlinear systems via state or output feedback. The author is one of the most prominent researchers in the field.

Essays on Control American Mathematical Soc.

This volume represents most aspects of the rich and growing field of nonlinear control. These proceedings contain 78 papers, including six plenary lectures, striking a balance between theory and

applications. Subjects covered include feedback stabilization, nonlinear and adaptive control of electromechanical systems, nonholonomic systems. Generalized state space systems, algebraic computing in nonlinear systems theory, decoupling, linearization and model-matching and robust control are also covered.

New Trends in Nonlinear Control Theory Springer Science & Business Media

This book presents methods to study the controllability and the stabilization of nonlinear control systems in finite and infinite dimensions. The emphasis is put on specific phenomena due to nonlinearities. In particular, many examples are given where nonlinearities turn out to be essential to get controllability or stabilization. Various methods are presented to study the controllability or to construct stabilizing feedback laws. The power of these methods is illustrated by numerous examples coming from such areas as celestial mechanics, fluid mechanics, and quantum mechanics. The book is addressed to graduate students in mathematics or control theory, and to mathematicians or engineers with an interest in nonlinear control systems governed by ordinary or partial differential equations.

Nonlinear System Theory Springer Science & Business Media

When M. Vidyasagar wrote the first edition of Nonlinear Systems Analysis, most control theorists considered the subject of nonlinear systems a mystery. Since then, advances in the application of differential geometric methods to nonlinear analysis have matured to a stage where every control theorist needs to possess knowledge of the basic techniques because virtually all physical systems are nonlinear in nature. The second edition, now republished in SIAM's Classics in Applied Mathematics series, provides a rigorous mathematical analysis of the behavior of nonlinear control systems under a variety of situations. It develops nonlinear generalizations of a large number of techniques and methods widely used in linear control theory. The book contains three extensive chapters devoted to the key topics of Lyapunov stability, input-output stability, and the treatment of differential geometric control theory. Audience: this text is designed for use at the graduate level in the area of nonlinear systems and as a resource for professional researchers and practitioners working in areas such as robotics, spacecraft control, motor control, and power systems.

Analysis and Design of Nonlinear Control Systems Springer

The purpose of this book is to present a self-contained description of the fundamentals of the theory of nonlinear control systems, with special emphasis on the differential geometric approach. The book is intended as a graduate text as well as a reference to scientists and engineers involved in the analysis and design of feedback systems. The first version of this book was written in 1983, while I was teaching at the Department of Systems Science and Mathematics at Washington University in St. Louis. This new edition integrates my subsequent teaching experience gained at the University of Illinois in Urbana-Champaign in 1987, at the Carl Cranz Gesellschaft in Oberpfaffenhofen in 1987, at the University of California in Berkeley in 1988. In addition to a major rearrangement of the last two Chapters of the first version, this new edition incorporates two additional Chapters at a more elementary level and an

exposition of some relevant research findings which have occurred since 1985. In the past few years differential geometry has proved to be an effective means of analysis and design of nonlinear control systems as it was in the past for the Laplace transform, complex variable theory and linear algebra in relation to linear systems. Synthesis problems of longstanding interest like disturbance decoupling, noninteracting control, output regulation, and the shaping of the input-output response, can be dealt with relative ease, on the basis of mathematical concepts that can be easily acquired by a control scientist.

High-Gain Observers in Nonlinear Feedback Control Springer

Control of nonlinear systems, one of the most active research areas in control theory, has always been a domain of natural convergence of research interests in applied mathematics and control engineering. The theory has developed from the early phase of its history, when the basic tool was essentially only the Lyapunov second method, to the present day, where the mathematics ranges from differential geometry, calculus of variations, ordinary and partial differential equations, functional analysis, abstract algebra and stochastic processes, while the applications to advanced engineering design span a wide variety of topics, which include nonlinear controllability and observability, optimal control, state estimation, stability and stabilization, feedback equivalence, motion planning, noninteracting control, disturbance attenuation, asymptotic tracking. The reader will find in the book methods and results which cover a wide variety of problems: starting from pure mathematics (like recent fundamental results on (non)analycity of small balls and the distance function), through its applications to all just mentioned topics of nonlinear control, up to industrial applications of nonlinear control algorithms.

Feedback Control of Linear and Nonlinear Systems Springer Science & Business Media

In the last two decades, the development of specific methodologies for the control of systems described by nonlinear mathematical models has attracted an ever increasing interest. New breakthroughs have occurred which have aided the design of nonlinear control systems. However there are still limitations which must be understood, some of which were addressed at the IFAC Symposium in Capri. The emphasis was on the methodological developments, although a number of the papers were concerned with the presentation of applications of nonlinear design philosophies to actual control problems in chemical, electrical and mechanical engineering.

Analysis and Design of Nonlinear Control Systems Springer

This volume deals with controllability and observability properties of nonlinear systems, as well as various ways to obtain input-output representations. The emphasis is on fundamental notions as (controlled) invariant distributions and submanifolds, together with algorithms to compute the required feedbacks.

Nonlinear Control Systems Elsevier

This book contains the text of the plenary lectures and the mini-courses of the European Control Conference (ECC'93) held in Groningen, the Netherlands, June 2S-July 1, 1993. However, the book is not your usu al conference proceedings. Instead, the authors took this occasion to take a

broad overview of the field of control and discuss its development both from a theoretical as well as from an engineering perpective. The first essay is by the key-note speaker ofthe conference, A.G.J. Mac Farlane. It consists of a non-technical discussion of information processing and knowledge acquisition as the key features of control engineering tech nology. The next six articles are accounts of the plenary addresses. The contribution by R.W. Brockett concerns a mathematical framework for modelling motion control, a central question in robotics and vision. In the paper by M. Morari the engineering and the economic relevance of chemical process control are considered, in particular statistical quality control and the control of systems with constraints. The article by A.C.P.M. Backx is written from an industrial perspec tive. The author is director of an engineering consulting firm involved in the design of industrial control equipment. Specifically, the possibility of obtaining high performance and reliable controllers by modelling, identifi cation, and optimizing industrial processes is discussed.

Nonlinear Control Design Springer

There has been much excitement over the emergence of new mathematical techniques for the analysis and control of nonlinear systems. In addition, great technological advances have bolstered the impact of analytic advances and produced many new problems and applications which are nonlinear in an essential way. This book lays out in a concise mathematical framework the tools and methods of analysis which underlie this diversity of applications.

Applied Nonlinear Control Springer Science & Business Media

One of the key concerns in modern control theory is the design of steering strategies. The implementation of such strategies is done by a regulator. Presented here is a self-contained introduction to the mathematical background of this type of regulator design. The topics selected address the matter of greatest interest to the control community, at present, namely, when the design objective is the reduction of the influence of exogeneous disturbances upon the output of the system. In a first scenario the disturbance signal is regarded as a deterministic time series with known dynamics but unknown parameters. The design objective is then the asymptotic disturbance compensation. In a second scenario, no information about the disturbance signal is available apart from some bounds. Here, in an H-approach, control strategies are worked out which will prove efficient for all such disturbances. The intention of this book is to present ideas and methods on such a level that the beginning graduate student will be able to follow current research. New results are included, especially for nonlinear control systems, and as a service to the reader, an extensive appendix presents topics from linear algebra, invariant manifolds and calculus of variations, information which is hardly to be found in standard textbooks. Contents: Introduction • The problem of output regulation • Introduction • Problem statement • Output regulation via full information • Output regulation via full error feedback • A particular case • Well-posedness and robustness • The construction of a robust regulator • Disturbance attenuation via H-methods • Introduction • Problem statement • A characterization of the L2-gain of a linear system • Disturbance attenuation via full

information • Disturbance attenuation via measured feedback • Full information regulators • Problem statement • Time-dependent control strategies • Examples • Time-independent control strategies • The local case • Nonlinear observers • Problem statement • Time-dependent observers • Error feedback regulators • Examples • Nonlinear H-techniques • Introduction • Construction of the saddle-point • The local scenario • Disturbance attenuation via linearization • Matrix equations • Linear matrix equations • Algebraic Riccati equations • Invariant manifolds • Existence theorem • Outflowing manifolds • Asymptotic phase • Convergence for T 1 • A special case • Dichotomies and Lyapunov functions • Hamilton-Jacobi-Bellman-Isaacs equation • Introduction • Method of characteristics • The equation of Isaacs • The Hamiltonian version of Isaacs' equation • Bibliography

Nonlinear Control Systems II Springer "Analysis and Design of Nonlinear Control Systems" provides a comprehensive and up to date introduction to nonlinear control systems, including system analysis and major control design techniques. The book is self-contained, providing sufficient mathematical foundations for understanding the contents of each chapter. Scientists and engineers engaged in the field of Nonlinear Control Systems will find it an extremely useful handy reference book. Dr. Daizhan Cheng, a professor at Institute of Systems Science, Chinese Academy of Sciences, has been working on the control of nonlinear systems for over 30 years and is currently a Fellow of IEEE and a Fellow of IFAC, he is also the chairman of Technical Committee on Control Theory, Chinese Association of Automation.

Output Regulation of Uncertain Nonlinear Systems Springer Science & Business Media

Chapter headings and selected papers: Controller Design for Nonlinear Systems. Global regulation problem for nonlinear systems (S.M. Fei, C.-B. Feng). Sliding Mode Control of Nonlinear Systems. Nonlinear sliding surface design in the presence of uncertainty (A. Loukianov et al.). H-Infinity and Nonlinear Control. Control of nonlinear systems via feedback linearization and constrained model predictive control (W.-K. Son, O.K. Kwon). Optimization and Related Topics I. Optimization of boundary and starting controls in multi-dimensional hyperbolic systems (A.V. Arguchintsev). Optimization and Related Topics II. The optimal stabilization of plasma under uncertainty conditions (V.F. Gubarev, O.S. Yakovlev). Advanced Applications of Genetic Algorithms. Multidisciplinary optimization with evolutionary computing for control design (W. Khatib et al.). Linear Quadratic Optimal Control. Singular optimal control problem of linear singular systems with linear-quadratic cost (Y. Chen et al.). Control Applications of Optimization. The optimal control of processing systems by economical criteria as applied to distillation (V.P. Krivosheev, A.Y. Torgashov). Optimal Control I. Stability properties of an iterative optimal control algorithm (P.D. Roberts). Optimal Control II. Quadratic index analysis in predictive control (J.S. Senent et al.). H-Infinity Control and Game Theoretical Approach. Game problem of approach under failure of controlling devices (A.A. Chikrii). Optimal Control Design. The Yakubovich-Kalman-Popov lemma and stability analysis of dynamic output feedback systems (R. Johansson, A. Robertsson).

Nonlinear Robust Control I. Robust stability of uncertain systems with differentiable nonlinearity (A. Gaiduk). Nonlinear Robust Control II. Robust nonlinear forwarding with smooth state feedback control (W.Z. Su, M. Fu). Optimal, Robust Control I. Robust reliable H∞ controllers design via LMIS (D. Hu, W.-H. Chen). Optimal, Robust Control II. A dynamic games approach to disturbance attenuation control of discrete-time descriptor systems (H. Xu). Author index. Keyword index.

Nonlinear Control and Analytical Mechanics SIAM

Nonlinear Control Systems and Power System Dynamics presents a comprehensive description of nonlinear control of electric power systems using nonlinear control theory, which is developed by the differential geometric approach and nonlinear robust control method. This book explains in detail the concepts, theorems and algorithms in nonlinear control theory, illustrated by step-by-step examples. In addition, all the mathematical formulation involved in deriving the nonlinear control laws of power systems are sufficiently presented. Considerations and cautions involved in applying nonlinear control theory to practical engineering control designs are discussed and special attention is given to the implementation of nonlinear control laws using microprocessors. Nonlinear Control Systems and Power System Dynamics serves as a text for advanced level courses and is an excellent reference for engineers and researchers who are interested in the application of modern nonlinear control theory to practical engineering control designs.